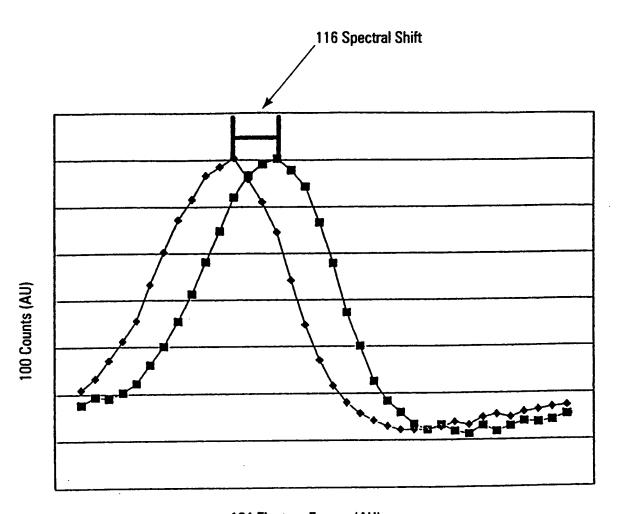
AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

Parker et al. 10/077,036

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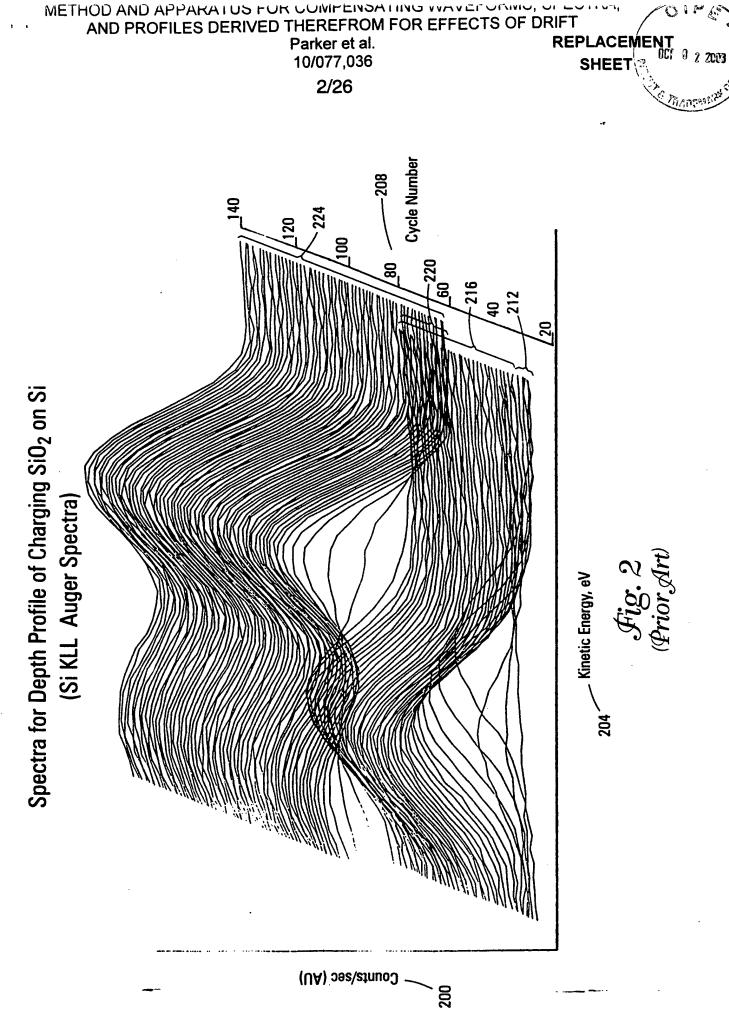
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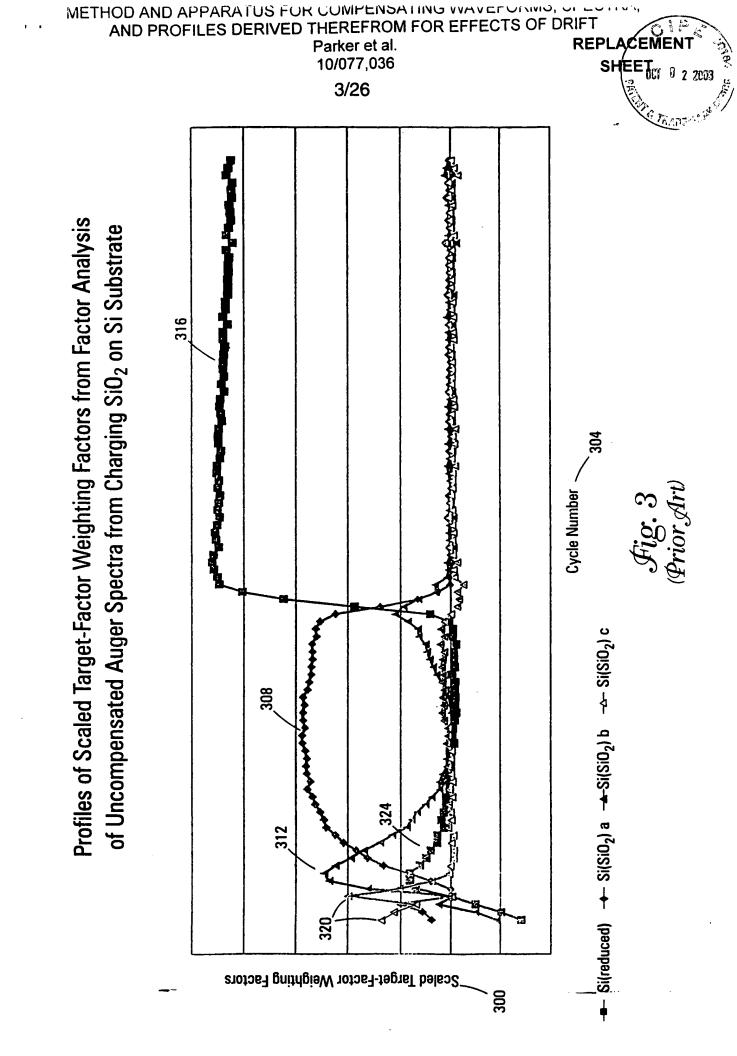


104 Electron Energy (AU)

108 Reference Spectrum
112 Shifted Spectrum

Fig. 1
(Prior Art)





AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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Fig. 4

Fig. 4a

/ 00 100 METHOD AND APPARATOS FOR AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT REPLACEMEN Parker et al. 10/077,036 SHEET OCT 0 2 2003 5/26 Phanements. SEQUENTIAL SPECTRA OBTAINED DRIFT-COMPENSATED ARRAY TO PROVIDE A SET OF DRIFT-COMPENSATED PRINCIPAL PERFORM A PRINCIPAL-FACTOR VECTORS, WHEREIN THE ARRAY OF DRIFT-COMPENSATED ROW TRANSFORM A PLURALITY OF DRIFT-COMPENSATED ARRAY DRIFT-CUMPENSATED ROW **VECTORS CONSTITUTES A TO PROVIDE AN ARRAY OF DETERMINATION ON THE** FROM A SPECTROMETER **ANALYTICAL RESULTS OUTPUT SELECTED FACTORS** RETURN 414 450 452 VECTORS, WHEREIN EACH SEQUENTIAL SPECTRUM CONSTITUTES A SUCCESSIVE ROW VECTOR OF THE PRIMAL APPLY AN EIGENANALYSIS TO THE COVARIANCE ARRAY TO DEPHASING PROCEDURE THAT TRANSFORMS THE PRIMAL INPUT A PLURALITY OF SEQUENTIAL SPECTRA FROM A FACTORS BY SELECTING A SUBSET OF EIGENVECTORS ORDER THE SPECTRA IN A PRIMAL ARRAY OF ROW REMOVE PHASE FACTORS DUE TO DRIFT USING A **DEFINE A COMPLETE SET OF EIGENVECTORS AND** DEFINE A SET OF DRIFT-COMPENSATED PRINCIPAL FROM THE COMPLETE SET OF EIGENVECTORS SPECTROMETER INTO A COMPUTER SYSTEM **ARRAY INTO A DRIFT-COMPENSATED ARRAY** FORM A COVARIANCE ARRAY FROM THE DRIFT-COMPENSATED ARRAY **EIGENVALUES** START ARRAY 408 404 412 416 420 450 452

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

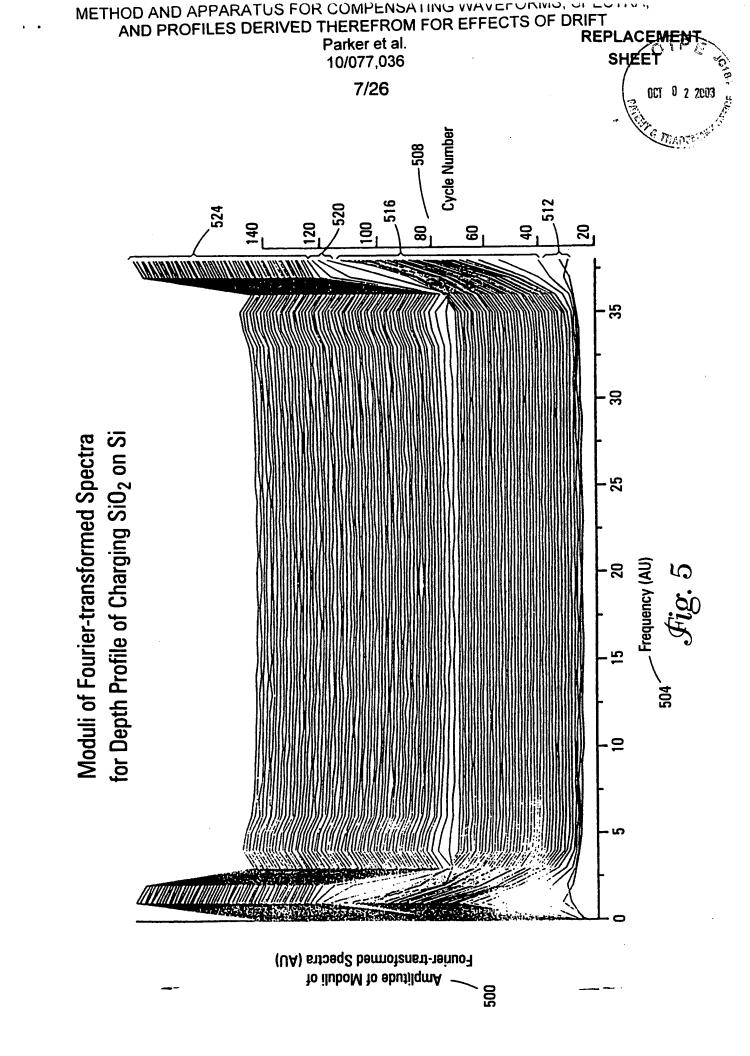
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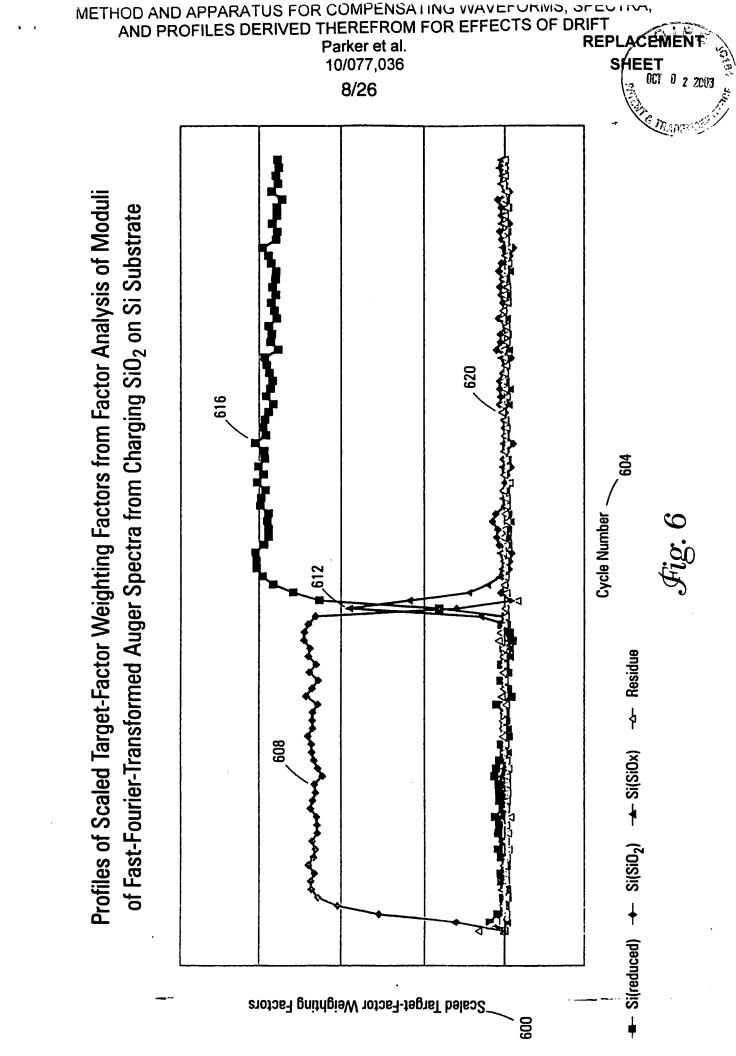
REPL Parker et al. 10/077,036 6/26 **VECTORS LYING WITHIN A SPACE** GENERATE DRIFT-COMPENSATED COMPOSITIONAL PROFILES PROFILES FROM A PROFILE DRIFT-COMPENSATED ROW OF DRIFT-COMPENSATED SCALED TARGET-FACTOR SCALED TARGET-FACTOR DRIFT-COMPENSATED TRAJECTORY OF THE DRIFT-COMPENSATED PRINCIPAL FACTORS FROM THE GENERATE **PROFILES** RETURN 454 438 **DRIFT-COMPENSATED TARGET FACTORS FOR THE PROFILE** SPACE OF DRIFT-COMPENSATED PRINCIPAL FACTORS TO SET OF TARGET-FACTOR WEIGHTING FACTORS, AND THE FACTORS TO A PROPFILE TRAJECTORY LYING WITHIN A SCALED TARGET-FACTOR PROFILES DERIVED FROM THE GROUP CONSISTING OF A SET OF DRIFT-COMPENSATED FACTORS ON A SPACE OF THE DRIFT-COMPENSATED PRINCIPAL FACTORS **OUTPUT ANALYTICAL RESULTS SELECTED FROM THE** CONSTRUCT A SET OF DRIFT-COMPENSATED TARGET APPLY THE SET OF DRIFT-COMPENSATED TARGET **OBTAIN A SEQUENTIAL SET OF TARGET-FACTOR** WEIGHTING FACTORS CORRESPONDING TO THE **SET OF DRIFT-COMPENSATED TARGET FACTORS** TRAJECTORY S

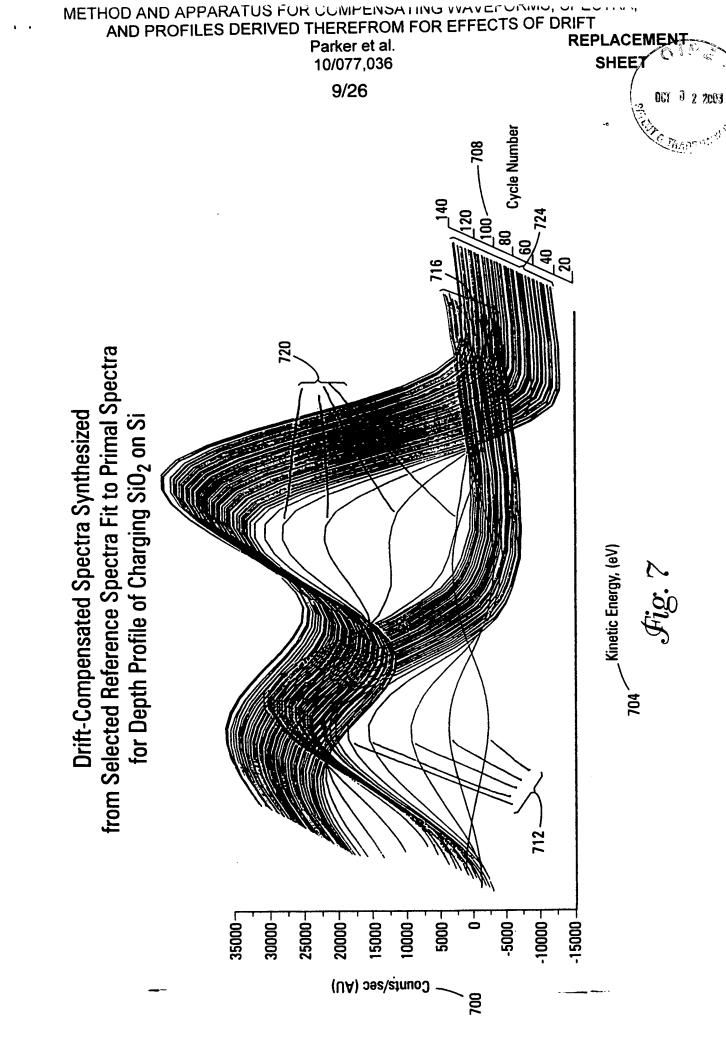
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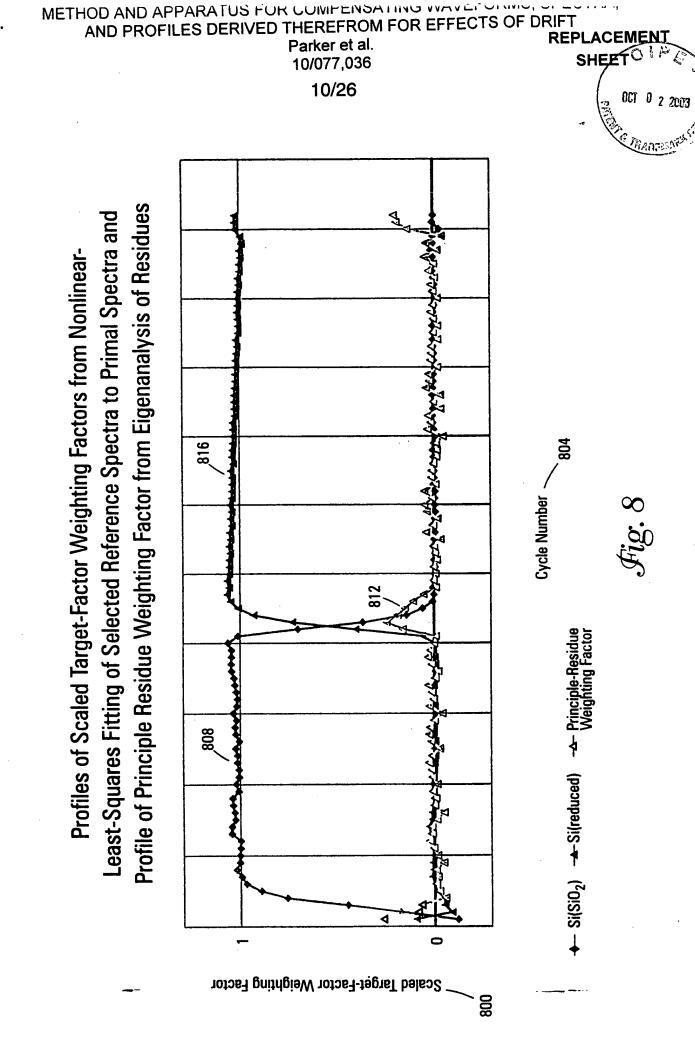
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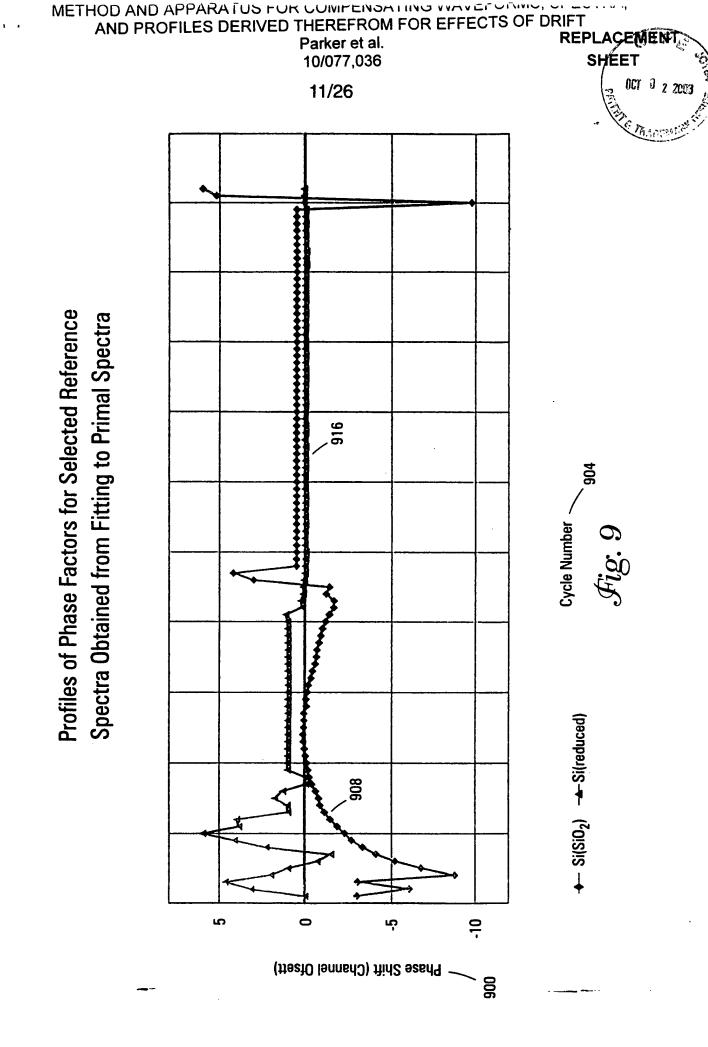
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METHOD AND APPARATUS FOR COMMETHOD THE PARATUS FOR COMMETHOD AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT REPLACEMENT Parker et al. 10/077,036 SHEET 12/26

REMOVE PHASE FACTORS DUE TO DRIFT USING A DEPHASING PROCEDURE THAT TRANSFORMS THE PRIMAL ARRAY INTO A DRIFT-COMPENSATED ARRAY 412

1000

412

APPLY A FOURIER TRANSFORM TO THE SPECTRA IN THE PRIMAL ARRAY OF ROW VECTORS FORMING AN ARRAY OF 1010 FOURIER-TRANSFORMED ROW VECTORS

MULTIPLY EACH FOURIER-TRANSFORMED ROW VECTOR BY A COMPLEX CONJUGATE OF EACH FOURIER-TRANSFORMED ROW VECTOR TO FORM A SQUARED MODULI VECTOR 1020THEREBY REMOVING PHASE FACTORS DUE TO DRIFT

TAKE THE SQUARE ROOT OF EACH ELEMENT OF THE SQUARED MODULI VECTOR TO CREATE A CORRESPONDING MODULI VECTOR

FORM A DRIFT-COMPENSATED ARRAY OF MODULI VECTORS BY SUCCESSIVELY SEQUENCING THE MODULI VECTORS AS SUCCESSIVE DRIFT-COMPENSATED ROW VECTORS IN A DRIFT-COMPENSATED ARRAY, WHEREIN THE MODULI VECTORS CONSTITUTE MODULI OF FOURIER-TRANSFORMED SPECTRA

METHOD AND APPARATUS FUR CUMPENSATING WAVELOUND, OF LOTTING,

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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REMOVE PHASE FACTORS DUE TO DRIFT USING A DEPHASING PROCEDURE THAT TRANSFORMS THE PRIMAL ARRAY INTO A **DRIFT-COMPENSATED ARRAY** 412

1100

412

APPLY A FITTING PROCEDURE TO EACH SPECTRUM IN THE PRIMAL ARRAY USING SELECTED REFERENCE SPECTRA 1110

CALCULATE THROUGH THE FITTING PROCEDURE A CORRESPONDING REFERENCE WEIGHTING FACTOR FOR EACH REFERENCE SPECTRUM CORRESPONDING TO EACH SPECTRUM IN THE PRIMAL ARRAY

REMOVE THE PHASE FACTOR DUE TO DRIFT FROM EACH SPECTRUM IN THE PRIMAL ARRAY BY SYNTHESIZING A CORRESPONDING DRIFT-COMPENSATED SPECTRUM GIVEN BY THE SUM OF EACH SELECTED REFERENCE SPECTRUM MULTIPLIED BY THE CORRESPONDING REFERENCE WEIGHTING FACTOR 1130

FORM A DRIFT-COMPENSATED ARRAY BY SUCCESSIVELY SEQUENCING THE DRIFT-COMPENSATED SPECTRA AS SUCCESSIVE DRIFT-COMPENSATED ROW VECTORS IN THE **DRIFT-COMPENSATED ARRAY** 1140

METHOD AND APPARATUS FOR CONFENSATING WAVE CORNS, OF LOTTING AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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PERFORM A PRINCIPAL-FACTOR
DETERMINATION ON THE
DRIFT-COMPENSATED ARRAY TO
PROVIDE A SET OF
DRIFT-COMPENSATED PRINCIPAL
452 FACTORS

452 1200 452 SELECT A SET OF INITIAL FACTORS FROM THE SET OF DRIFT-COMPENSATED ROW VECTORS OF THE **DRIFT-COMPENSATED ARRAY** 1210 PERFORM A LINEAR-LEAST-SQUARES DECOMPOSITION WITH THE SET OF INITIAL FACTORS ON THE DRIFT-COMPENSATED ROW VECTORS IN THE DRIFT-COMPENSATED ARRAY TO PROVIDE A SET OF **RESIDUE FACTORS** 1220 PERFORM A GRAM-SCHMIDT ORTHONORMALIZATION ON THE COMBINED SET OF INITIAL FACTORS AND RESIDUE FACTORS TO PROVIDE DRIFT-COMPENSATED PRINCIPAL FACTORS 1230

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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CONSTRUCT A SET OF DRIFT-COMPENSATED TARGET FACTORS ON A SPACE OF THE DRIFT-COMPENSATED PRINCIPAL 428 FACTORS

1300

428

GENERATE A PROFILE TRAJECTORY ON A 3-DIMENSIONAL PROJECTION OF A 4-DIMENSIONAL SPACE OF A SET OF FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS ALONG WITH A REFERENCE TETRAHEDRON THE VERTICES OF WHICH REPRESENT EACH OF THE FIRST-FOUR, 1310 DRIFT-COMPENSATED PRINCIPAL FACTORS

ENCLOSE THE PROFILE TRAJECTORY WITHIN AN ENCLOSING TETRAHEDRON WITH VERTICES CENTERED ON END-POINTS AND IN PROXIMITY TO TURNING POINTS OF THE PROFILE TRAJECTORY, AND WITH FACES LYING ESSENTIALLY TANGENT TO PORTIONS OF THE PROFILE 1320 TRAJECTORY

CALCULATE THE DRIFT-COMPENSATED TARGET FACTORS FROM THE NORMED COORDINATES OF THE VERTICES OF THE ENCLOSING TETRAHEDRON IN TERMS OF THE 1330 DRIFT-COMPENSATED PRINCIPAL FACTORS

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GENERATE A PROFILE
TRAJECTORY ON A
3-DIMENSIONAL PROJECTION OF
A 4-DIMENSIONAL SPACE OF A
FIRST-FOUR,
DRIFT-COMPENSATED PRINCIPAL
FACTORS ALONG WITH A
REFERENCE TETRAHEDRON THE
VERTICES OF WHICH REPRESENT
EACH OF THE FIRST-FOUR,
DRIFT-COMPENSATED PRINCIPAL
1310 FACTORS

1400

<u>1310</u>

1410 CALCULATE 4-SPACE COORDINATES OF A PROFILE TRAJECTORY OF DRIFT-COMPENSATED TARGET-FACTOR PROFILES ON A 4-DIMENSIONAL SPACE TO PRODUCE FOUR COORDINATES FOR EACH POINT IN THE PROFILE TRAJECTORY, ONE COORDINATE FOR EACH OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS

REDUCE THE DIMENSIONALITY OF THE COORDINATES OF THE PROFILE TRAJECTORY BY DIVIDING EACH COORDINATE BY A SUM OF ALL FOUR 4-SPACE COORDINATES TO PRODUCE NORMED COORDINATES FOR THE PROFILE 1420 TRAJECTORY

PLOT THE NORMED COORDINATES FOR THE PROFILE
TRAJECTORY IN A 3-DIMENSIONAL SPACE THE
COORDINATES AXES OF WHICH ARE EDGES OF A
REFERENCE TETRAHEDRON, THE VERTICES OF WHICH
CORRESPOND TO UNIT VALUES FOR EACH OF THE
FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL FACTORS IN A
MANNER ANALOGOUS TO PLOTTING OF COORDINATES ON A
1430
QUATERNARY PHASE DIAGRAM

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

D PROFILES DERIVED THEREFROM Parker et al. 10/077.036

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**ENCLOSE THE PROFILE** TRAJECTORY WITHIN AN ENCLOSING TETRAHEDRON WITH **VERTICES CENTERED ON END-POINTS AND IN PROXIMITY** TO TURNING POINTS OF THE PROFILE TRAJECTORY, AND WITH FACES LYING ESSENTIALLY TANGENT TO PORTIONS OF THE PROFILE TRAJECTORY; AND, **CALCULATE THE** DRIFT-COMPENSATED TARGET FACTORS FROM THE NORMED **COORDINATES OF THE VERTICES** OF THE ENCLOSING TETRAHEDRON IN TERMS OF THE DRIFT-COMPENSATED PRINCIPAL 1320 & 1330 FACTORS

1500

## 1320 & 1330

PLACE VERTICES OF AN ENCLOSING TETRAHEDRON AT LOCI OF HEAVY POINT CONCENTRATIONS OF A PROFILE 1510 TRAJECTORY

ADJUST THE EDGES OF AN ENCLOSING TETRAHEDRON TO LIE ALONG ESSENTIALLY STRAIGHT LINE SEGMENTS

PLACE REMAINING VERTICES OF AN ENCLOSING TETRAHEDRON SO AS TO LIE NEAR THE TURNING POINTS OF 1530 THE PROFILE TRAJECTORY

ADJUST THE FACES OF THE ENCLOSING TETRAHEDRON TO LIE ALONG CURVED SEGMENTS JOINING A TURNING POINT AND ESSENTIALLY STRAIGHT LINE SEGMENTS OF THE 1540 PROFILE TRAJECTORY

METHOD AND APPARATUS FUR CUIVIFEINSATING VVAVEFURIVIO, OFFUTION, AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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Fig. 16a

Fig. 16b

METHOD AND APPARATUS FOR COMPENSATING WAVEFORMS, SCEOTICS,
AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT
REPLACE

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DRAG THE VERTICES OF THE ENCLOSING TETRAHEDRON TO THE LOCI OF HEAVY POINT CONCENTRATIONS IN THE 630 **ESSENTIALLY SPANNING THE SPACE OF THE PROJECTIONS** ETRAHEDRON TO POSITION THEM IN THE VICINITY OF ANY AND, PLACE THE FACES OF THE ENCLOSING TETRAHEDRON ON OR IN CLOSE PROXIMITY TO ANY CURVED PORTIONS OF TRAJECTORY USING SOFTWARE BASED ON METHODS WEL PROXIMITY TO EDGES OF THE ENCLOSING TETRAHEDRON **TURNING POINTS IN THE PROFILE TRAJECTORY SO THAT IRAJECTORY OF THE PROJECTIONS OF A SEQUENCE OF** GENERATE AN ENCLOSING TETRAHEDRON BY STARTING **ESSENTIALLY STRAIGHT LINE SEGMENTS LIE IN CLOSE** WITH A COPY OF THE REFERENCE TETRAHEDRON AND KNOWN IN THE ART OF THE DISPLAY OF GRAPHICALLY DRAG ANY REMAINING VERTICES OF THE ENCLOSING **ROW VECTORS AND THE REFERENCE TETRAHEDRON** OF THE FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL THE TRAJECTORY THAT CONNECT TURNING POINTS **MOVING ITS VERTICES TO ENCLOSE THE PROFILE** 1610 display on a computer monitor the profile **GENERATED COMPUTER OBJECTS FACTORS** 1620 1630 1640

Fig. 16a

METHOU AND APPARATUS FUN CONTENSATING WAVEL CHANG, OF TOTAL

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT Parker et al.

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DRIFT-COMPENSATED TARGET FACTORS FROM THE NORMALIZED FIRST-FOUR, DRIFT-COMPENSATED PRINCIPAL **ENCLOSING-VERTEX WEIGHTING FACTOR WITH THE VECTOR** PROVIDING AN ENCLOSING TETRAHEDRON, THE VERTICES OF WHICH CORRESPOND WITH THE DRIFT-COMPENSATED TARGET FACTORS OF THE ANALYSIS **VERTICES OF THE ENCLOSING TETRAHEDRON TO ENCLOSE** MINIMAL VOLUME THAT BEST FITS THE DRIFT CORRECTED DEFINE THE NORMED COORDINATES OF THE VERTICES OF TARGET FACTORS FOR EACH VERTEX OF THE ENCLOSING TETRAHEDRON BY SUMMING THE PRODUCTS OF EACH APPLY MINOR ADJUSTMENTS TO THE LOCATION OF THE REFERENCE TETRAHEDRON AS THE ENCLOSING-VERTEX **OBTAIN THE VECTORS GIVING THE DRIFT-COMPENSATED** THE SUBSPACE OF THE PROFILE TRAJECTORY WITH A **CORRESPONDS TO EACH VERTEX OF THE REFERENCE** DATA REPRESENTED BY THE PROFILE TRAJECTORY, THE ENCLOSING TETRAHEDRON RELATIVE TO THE **DRIFT-COMPENSATED PRINCIPAL FACTOR THAT** WEIGHTING FACTORS USED TO OBTAIN THE GIVING THE NORMALIZED FIRST-FOUR, 1650 1660 1670

Fig. 16b

AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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Fig. 17a

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AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

REPLACEMEN METHOD AND APPAKAT Parker et al. 10/077,036 SHEET 22/26 OCT O 2 2003 DRIFT-COMPENSATED SCALED SELECTED FROM THE GROUP DRIFT-COMPENSATED TARGE DERIVED FROM THE SET OF IARGET-FACTOR WEIGHTING **DUTPUT ANALYTICAL RESULT** FACTORS, AND THE SET OF TARGET-FACTOR PROFILES **CONSISTING OF A SET OF FACTORS OBTAIN THE SET OF DRIFT-COMPENSATED TARGET-FACTOR** VECTOR TO OPTIMALLY MATCH THE CORRESPONDING ROW CORRESPONDING TO THE DRIFT-COMPENSATED TARGET FACTORS BY THE TARGET-FACTOR WEIGHTING FACTORS SCALE THE AMPLITUDE OF THE RESULTING REFERENCE DRIFT-COMPENSATED TARGET FACTORS TO THE PROFIL MANNER ANALOGOUS TO FINDING COORDINATES OF COMPOSE A REFERENCE VECTOR BY SUMMING THE PRODUCTS FROMED BY MULTIPLYING THE VECTORS 730 VECTOR COMPENSATED FOR THE EFFECTS OF DRIFT IRAJECTORY, I.E. THE TARGET-FACTOR WEIGHTING FACTORS, FROM THE ENCLOSING TETRAHEDRON IN COORDINATES OF EACH POINT ON THE PROFILE **FOR EACH POINT ON THE PROFILE TRAJECTORY** TRAJECTORY BY ASCERTAINING THE NORMED POINT ON A QUARTERNARY PHASE DIAGRAM PROFILE VALUES BY APPLYING THE SET OF ig. 17a

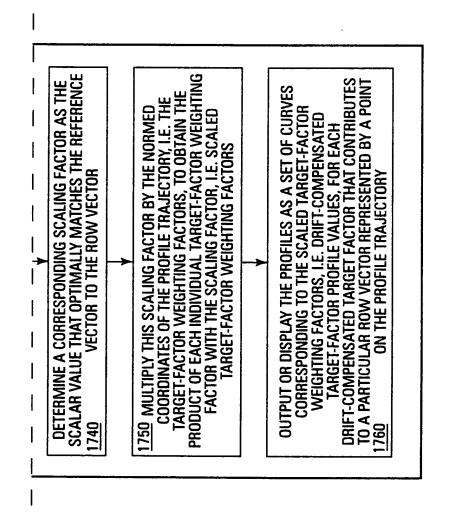
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METHOD AND APPAKATUS FOR AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

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METHOD AND APPAKATUS FUR CUIVIFEINSATING WAVEFULLING, AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT

Parker et al.

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DEFINE A SET OF DRIFT-COMPENSATED SCALED TARGET-FACTOR PROFILE VALUES AS THE SET OF SCALED TARGET-FACTOR WEIGHTING FACTORS 1810

**DIVIDE EACH DRIFT-COMPENSATED SCALED** TARGET-FACTOR PROFILE VALUE BY A PROFILE SENSITIVITY FACTOR FOR EACH CONSTITUENT CORRESPONDING TO THE TARGET FACTOR TO PROVIDE A SENSITIVITY-SCALED 1820 TARGET-FACTOR PROFILE VALUE

NORMALIZE THE SENSITIVITY-SCALED TARGET-FACTOR PROFILE VALUE BY DIVIDING EACH SENSITIVITY-SCALED TARGET-FACTOR PROFILE VALUE FOR A GIVEN CYCLE NUMBER BY THE SUM OF ALL THE SENSITIVITY-SCALED TARGET-FACTOR PROFILE VALUES FOR THE GIVEN CYCLE NUMBER TO PROVIDE DRIFT-COMPENSATED COMPOSITIONAL PROFILE VALUES AT THE GIVE CYCLE 1830 NUMBER

**OUTPUT THE DRIFT-COMPENSATED COMPOSITIONAL** PROFILE VALUES AS A SET OF DRIFT-COMPENSATED **COMPOSITIONAL PROFILES** 1840

METHOD AND APPARATUS FUR CUIVIPEINSATING VVAVERORIVIS, SEESTIVS, AND PROFILES DERIVED THEREFROM FOR EFFECTS OF DRIFT REPLACEMENT Parker et al. 10/077,036 SHEE/T 26/26 2000 2020 **COMPUTER SYSTEM** 2030 **PROGRAM INPUT DEVICES** 2014 <u>2010</u> 2040 **COMPUTER PROCESSING ELEMENTS** 

Fig. 20

<u>2050</u>

**OUTPUT DEVICES**